WHAT IS CLAIMED IS:

1. An exchange coupling film comprising an antiferromagnetic layer and a ferromagnetic layer in contact with the antiferromagnetic layer, an exchange coupling magnetic field generated at the interface between the antiferromagnetic layer and the ferromagnetic layer magnetizing the antiferromagnetic layer in a particular direction,

wherein the antiferromagnetic layer comprises an antiferromagnetic material containing Mn and X, wherein X is at least one element selected from the group consisting Pt, Pd, Ir, Rh, Ru, and Os, and

wherein crystal planes of the antiferromagnetic layer and the ferromagnetic layer preferentially aligned parallel to the interface are crystallographically identical, and crystallographically identical axes lying in said crystal planes are oriented, at least partly, in different directions between the antiferromagnetic layer and the ferromagnetic layer.

2. An exchange coupling film according to Claim 1, wherein the crystal planes are the crystallographically identical planes generically described as the {111} planes.

3. An exchange coupling film according to Claim 2, wherein the crystallographically identical axes are the axes

generically described as the <110> axes.

4. An exchange coupling film according to Claim 1, wherein the antiferromagnetic layer and the ferromagnetic layer are deposited in that order from the bottom,

the exchange coupling film further comprising a seed layer provided below the antiferromagnetic layer, the seed layer mainly having a face-centered cubic structure and having one of the crystallographically identical planes generically described as the {111} planes preferentially aligned parallel to the interface.

5. An exchange coupling film according to Claim 4, wherein the seed layer comprises one of a NiFe alloy and a Ni-Fe-Y alloy, wherein Y is at least one element selected from the group consisting of Cr, Rh, Ta, Hf, Nb, Zr, and Ti.

6. An exchange coupling film according to Claim 4, wherein the seed layer is nonmagnetic at room temperature.

7. An exchange coupling film according to Claim 4, further comprising an underlayer provided under the seed layer, the underlayer comprising at least one element selected from the group consisting of Ta, Hf, Nb, Zr, Ti, Mo, and W.

8. An exchange coupling film according to Claim 4,

wherein at least part of the interface between the antiferromagnetic layer and the seed layer is in a lattice-mismatching state.

9. An exchange coupling film according to Claim 1, the antiferromagnetic material further comprising X', wherein X' is at least one element selected from the group consisting of Ne, Ar, Kr, Xe, Be, B, C, N, Mg, Al, Si, P, Ti, V, Cr, Fe, Co, Ni, Cu, Zn, Ga, Ge, Zr, Nb, Mo, Ag, Cd, Sn, Hf, Ta, W, Re, Au, Pb, and rare earth elements.

10. An exchange coupling film according to Claim 9, wherein the antiferromagnetic material is an interstitial solid solution in which said X' is inserted to interstices in the lattice formed by X and Mn or a substitutional solid solution in which said X' partly displaces the lattice points in the crystal lattice formed by X and Mn.

11. An exchange coupling film according to Claim 10, wherein the X or X + X' content in the antiferromagnetic material is in the range of 45 to 60 atomic percent.

12. An exchange coupling film according to Claim 1, wherein at least part of the interface between the antiferromagnetic layer and the ferromagnetic layer is in a lattice-mismatching state.

13. A magnetoresistive element comprising:

an exchange coupling film according to Claim 1;

a free magnetic layer formed on the pinned magnetic layer separated by a nonmagnetic interlayer; and

bias layers for magnetizing the free magnetic layer in a direction substantially orthogonal to the magnetization vector of the pinned magnetic layer.

14. A magnetoresistive element comprising:

an antiferromagnetic layer;

a pinned magnetic layer in contact with the antiferromagnetic layer, the magnetization vectors of the pinned magnetic layer being pinned by an exchange anisotropic magnetic field generated in relation to the antiferromagnetic layer;

a free magnetic layer formed on the pinned magnetic layer separated by a nonmagnetic interlayer; and

antiferromagnetic exchange bias layers formed above or below the free magnetic layer, the exchange bias layers being separated from one another in a track width direction by a gap therebetween,

wherein the exchange bias layers and the free magnetic layer comprise an exchange coupling film according to Claim 1, the exchange bias layers corresponding to the antiferromagnetic layer and the free magnetic layer corresponding to the ferromagnetic layer, so as to magnetize the free magnetic layer in a particular direction.

15. A magnetoresistive element comprising:

nonmagnetic interlayers provided above and below a free magnetic layer;

pinned magnetic layers, one thereof being provided on the pinned magnetic layer formed on the free magnetic layer and the other being provided under the pinned magnetic layer formed under the free magnetic layer;

antiferromagnetic layers for pinning the magnetization vectors of the pinned magnetic layers, one of the antiferromagnetic layers being provided on one of the pinned magnetic layers and the other being provided under the other of the pinned magnetic layers; and

bias layers for orienting the magnetization vector of the free magnetic layer in a direction substantially orthogonal to the magnetization vector of the pinned magnetic layer,

wherein each antiferromagnetic layer and the pinned magnetic layer in contact with the antiferromagnetic layer comprise an exchange coupling film according to Claim 1, the pinned magnetic layer corresponding to the ferromagnetic layer.

16. A magnetoresistive element comprising:

a magnetoresistive layer;

a soft magnetic layer provided on the magnetoresistive layer separated by a nonmagnetic layer therebetween; and

antiferromagnetic layers provided above or below the magnetoresistive layer, the antiferromagnetic layers being separated from one another in a track width direction with a gap therebetween,

wherein the antiferromagnetic layers and the magnetoresistive layer comprise an exchange coupling film according to Claim 1, the magnetoresistive layer corresponding to the ferromagnetic layer.

17. An exchange coupling film comprising an antiferromagnetic layer and a ferromagnetic layer in contact with the antiferromagnetic layer, in which an exchange coupling magnetic field generated at the interface between the antiferromagnetic layer and the ferromagnetic layer magnetizes the ferromagnetic layer in a particular direction,

wherein diffraction spots corresponding to reciprocal lattice points indicative of crystal planes of the antiferromagnetic layer and the ferromagnetic layer appear in transmission electron beam diffraction diagrams of the antiferromagnetic layer and the ferromagnetic layer obtained using an electron beam in a direction parallel to the interface,

wherein first imaginary lines in the diffraction diagrams of the antiferromagnetic layer and the ferromagnetic layer, the first imaginary lines each connecting a beam origin and a particular one of the diffraction spots which is given the same label in both the

diffraction diagrams of the antiferromagnetic layer and the ferromagnetic layer and which is located in a layer thickness direction when viewed from the beam origin, are coincident with each other, and

wherein second imaginary line in the diffraction diagrams of the antiferromagnetic layer and the ferromagnetic layer, the second imaginary lines each connecting the beam origin and a particular one of the diffraction spots which is given the same label in both the diffraction diagrams of the antiferromagnetic layer and the ferromagnetic layer and which is located in a direction other than the layer thickness direction when viewed from the beam origin, are not coincident with each other.

18. An exchange coupling film according to Claim 17, wherein the diffraction spots located in the layer thickness direction are assigned to the {111} planes.

19. An exchange coupling film according to Claim 17, wherein the antiferromagnetic layer and the ferromagnetic layer are deposited in that order from the bottom,

the exchange coupling film further comprising a seed layer provided below the antiferromagnetic layer, the seed layer mainly having a face-centered cubic structure and having the crystallographically identical planes generically described as the {111} planes, one of the {111} planes being preferentially aligned parallel to the interface.

20. An exchange coupling film according to Claim 19, wherein the seed layer comprises one of a NiFe alloy and a Ni-Fe-Y alloy, wherein Y is at least one element selected from the group consisting of Cr, Rh, Ta, Hf, Nb, Zr, and Ti.

21. An exchange coupling film according to Claim 19, wherein the seed layer is nonmagnetic at room temperature.

22. An exchange coupling film according to Claim 19, further comprising an underlayer provided under the seed layer, the underlayer comprising at least one element selected from the group consisting of Ta, Hf, Nb, Zr, Ti, Mo, and W.

23. An exchange coupling film according to Claim 19, wherein at least part of the interface between the antiferromagnetic layer and the seed layer is in a lattice-mismatching state.

24. An exchange coupling film according to Claim 19, the antiferromagnetic material further comprising X', wherein X' is at least one element selected from the group consisting of Ne, Ar, Kr, Xe, Be, B, C, N, Mg, Al, Si, P, Ti, V, Cr, Fe, Co, Ni, Cu, Zn, Ga, Ge, Zr, Nb, Mo, Ag, Cd, Sn, Hf, Ta, W, Re, Au, Pb, and rare earth elements.

25. An exchange coupling film according to Claim 24, wherein the antiferromagnetic material is an interstitial solid solution in which X' is inserted to interstices in the lattice formed by X and Mn or a substitutional solid solution in which X' partly displaces the lattice points in the crystal lattice formed by X and Mn.

26. An exchange coupling film according to Claim 25, wherein the X or X + X' content in the antiferromagnetic material is in the range of 45 to 60 atomic percent.

27. An exchange coupling film according to Claim 17, wherein at least part of the interface between the antiferromagnetic layer and the ferromagnetic layer is in a lattice-mismatching state.

28. A magnetoresistive element comprising:

an antiferromagnetic layer;

a pinned magnetic layer in contact with the antiferromagnetic layer, the magnetization vector of the pinned magnetic layer being pinned by an exchanged anisotropic magnetic field generated in relation to the antiferromagnetic layer;

a free magnetic layer formed on the pinned magnetic layer separated by a nonmagnetic interlayer therebetween; and

bias layers for orienting the magnetization vector of

the free magnetic layer in a direction substantially orthogonal to the magnetization vector of the pinned magnetic layer,

wherein the antiferromagnetic layer and the pinned magnetic layer comprise an exchange coupling film according to Claim 17, the pinned magnetic layer corresponding to the ferromagnetic layer.

29. A magnetoresistive element comprising:

an antiferromagnetic layer;

a pinned magnetic layer in contact with the antiferromagnetic layer, the magnetization vectors of the pinned magnetic layer being pinned by an exchange anisotropic magnetic field generated in relation with the antiferromagnetic layer;

a free magnetic layer formed on the pinned magnetic layer separated by a nonmagnetic interlayer; and

antiferromagnetic exchange bias layers formed above or under the free magnetic layer, the exchange bias layers being separated from one another in a track width direction by a gap therebetween,

wherein the exchange bias layers and the free magnetic layer comprise an exchange coupling film according to Claim 17, the exchange bias layers corresponding to the antiferromagnetic layer and the free magnetic layer corresponding to the ferromagnetic layer.

30. A magnetoresistive element comprising:

nonmagnetic interlayers provided above and below a free magnetic layer;

pinned magnetic layers, one thereof being provided on the pinned magnetic layer formed on the free magnetic layer and the other being provided under the pinned magnetic layer formed under the free magnetic layer;

antiferromagnetic layers for pinning the magnetization vectors of the pinned magnetic layers, one of the antiferromagnetic layers being provided on one of the pinned magnetic layers and the other being provided under the other of the pinned magnetic layers; and

bias layers for orienting the magnetization vector of the free magnetic layer in a direction substantially orthogonal to the magnetization vector of the pinned magnetic layer,

wherein the antiferromagnetic layer and the pinned magnetic layer in contact with the antiferromagnetic layer comprise an exchange coupling film according to Claim 17, the pinned magnetic layer corresponding to the ferromagnetic layer.

31. A magnetoresistive element comprising:

a magnetoresistive layer;

a soft magnetic layer provided on the magnetoresistive layer separated by a nonmagnetic layer therebetween; and

antiferromagnetic layers provided above or below the

magnetoresistive layer, the antiferromagnetic layers being separated from one another in a track width direction with a gap therebetween,

wherein the antiferromagnetic layer and the magnetoresistive layer comprise an exchange coupling film according to Claim 17, the magnetoresistive layer corresponding to the ferromagnetic layer.

32. An exchange coupling film comprising an antiferromagnetic layer and a ferromagnetic layer in contact with the antiferromagnetic layer, in which an exchange coupling magnetic field generated at the interface between the antiferromagnetic layer and the ferromagnetic layer orients the magnetization vector of the ferromagnetic layer in a particular direction,

wherein diffraction spots corresponding to reciprocal lattice points indicative of crystal planes of the antiferromagnetic layer and the ferromagnetic layer appear in transmission electron beam diffraction diagrams of the antiferromagnetic layer and the ferromagnetic layer obtained using an electron beam in a direction parallel to the interface,

wherein first imaginary lines in the diffraction diagrams of the antiferromagnetic layer and the ferromagnetic layer, the first imaginary lines each connecting a beam origin and a particular one of the diffraction spots which is given the same label in both the

group consisting of Cr, Rh, Ta, Hf, Nb, Zr, and Ti.

36. An exchange coupling film according to Claim 34, wherein the seed layer is nonmagnetic at room temperature.

37. An exchange coupling film according to Claim 34, further comprising an underlayer provided under the seed layer, the underlayer comprising at least one element selected from the group consisting of Ta, Hf, Nb, Zr, Ti, Mo, and W.

38. An exchange coupling film according to Claim 34, wherein at least part of the interface between the antiferromagnetic layer and the seed layer is in a lattice-mismatching state.

39. An exchange coupling film according to Claim 32, the antiferromagnetic material further comprising X', wherein X' is at least one element selected from the group consisting of Ne, Ar, Kr, Xe, Be, B, C, N, Mg, Al, Si, P, Ti, V, Cr, Fe, Co, Ni, Cu, Zn, Ga, Ge, Zr, Nb, Mo, Ag, Cd, Sn, Hf, Ta, W, Re, Au, Pb, and rare earth elements.

40. An exchange coupling film according to Claim 39, wherein the antiferromagnetic material is an interstitial solid solution in which X' is inserted to interstices in the lattice formed by X and Mn or a substitutional solid

solution in which X' partly displaces the lattice points in the crystal lattice formed by X and Mn.

41. An exchange coupling film according to Claim 40, wherein the X or X + X' content in the antiferromagnetic material is in the range of 45 to 60 atomic percent.

42. An exchange coupling film according to Claim 32, wherein at least part of the interface between the antiferromagnetic layer and the ferromagnetic layer is in a lattice-mismatching state.

43. A magnetoresistive element comprising:

an antiferromagnetic layer;

a pinned magnetic layer in contact with the antiferromagnetic layer, the magnetization vector of the pinned magnetic layer being pinned by an exchanged anisotropic magnetic field generated in relation to the antiferromagnetic layer;

a free magnetic layer formed on the pinned magnetic layer separated by a nonmagnetic interlayer therebetween; and

bias layers for orienting the magnetization vector of the free magnetic layer in a direction substantially orthogonal to the magnetization vector of the pinned magnetic layer,

wherein the antiferromagnetic layer and the pinned

diffraction diagrams of the antiferromagnetic layer and the ferromagnetic layer and is located in a layer thickness direction when viewed from the beam origin, are coincident with each other, and

wherein a particular diffraction spot indicative of a particular crystal plane, located in a direction other than the layer thickness direction, appears only in one of the diffraction diagrams of the antiferromagnetic layer and the ferromagnetic layer.

33. An exchange coupling film according to Claim 32, wherein the diffraction spots located in the layer thickness direction are assigned to the {111} planes.

34. An exchange coupling film according to Claim 32, wherein the antiferromagnetic layer and the ferromagnetic layer are deposited in that order from the bottom,

the exchange coupling film further comprising a seed layer provided below the antiferromagnetic layer, the seed layer mainly having a face-centered cubic structure and having the crystallographically identical planes generically described as the {111} planes, one of which is preferentially aligned parallel to the interface.

35. An exchange coupling film according to Claim 34, the seed layer comprising one of a NiFe alloy and a Ni-Fe-Y alloy, wherein Y is at least one element selected from the

magnetic layer comprises an exchange coupling film according to Claim 32, the pinned magnetic layer corresponding to the ferromagnetic layer.

44. A magnetoresistive element comprising:

an antiferromagnetic layer;

a pinned magnetic layer in contact with the antiferromagnetic layer, the magnetization vectors of the pinned magnetic layer being pinned by an exchange anisotropic magnetic field generated in relation to the antiferromagnetic layer;

a free magnetic layer formed on the pinned magnetic layer separated by a nonmagnetic interlayer; and

antiferromagnetic exchange bias layers formed above or under the free magnetic layer, the exchange bias layers being separated from one another in a track width direction by a gap therebetween,

wherein the exchange bias layers and the free magnetic layer comprise an exchange coupling film according to Claim 32, the exchange bias layers corresponding to the antiferromagnetic material and the free magnetic layer corresponding to the ferromagnetic layer.

45. A magnetoresistive element comprising:

nonmagnetic interlayers provided above and below a free magnetic layer;

pinned magnetic layers, one thereof being provided on

the pinned magnetic layer formed on the free magnetic layer and the other being provided under the pinned magnetic layer formed under the free magnetic layer;

antiferromagnetic layers for pinning the magnetization vectors of the pinned magnetic layers, one of the antiferromagnetic layers being provided on one of the pinned magnetic layers and the other being provided under the other of the pinned magnetic layers; and

bias layers for orienting the magnetization vector of the free magnetic layer in a direction substantially orthogonal to the magnetization vector of the pinned magnetic layer,

wherein the antiferromagnetic layer and the pinned magnetic layer in contact with the antiferromagnetic layer comprise an exchange coupling film according to Claim 32, the pinned magnetic layer corresponding to the ferromagnetic layer.

46. A magnetoresistive element comprising:

a magnetoresistive layer;

a soft magnetic layer provided on the magnetoresistive layer separated by a nonmagnetic layer therebetween; and

antiferromagnetic layers provided above or below the magnetoresistive layer, the antiferromagnetic layers being separated from one another in a track width direction with a gap therebetween,

wherein the antiferromagnetic layer and the

magnetoresistive layer comprise an exchange coupling film according to Claim 32, the magnetoresistive layer corresponding to the ferromagnetic layer.

47. An exchange coupling film comprising an antiferromagnetic layer and a ferromagnetic layer in contact with the antiferromagnetic layer, an exchange coupling magnetic field generated at the interface between the antiferromagnetic layer and the ferromagnetic layer magnetizing the ferromagnetic layer in a particular direction,

wherein diffraction spots corresponding to reciprocal lattice points indicative of crystal planes of the antiferromagnetic layer and the ferromagnetic layer appear in transmission electron beam diffraction diagrams of the antiferromagnetic layer and the ferromagnetic layer obtained using an electron beam in a direction perpendicular to the interface, and

wherein an imaginary line in the diffraction diagram of the antiferromagnetic layer connecting a beam origin and a diffraction spot given a particular label and an imaginary line in the diffraction diagram of the ferromagnetic layer connecting the beam origin and a diffraction spot given the same label are not coincident with each other.

48. An exchange coupling film according to Claim 47, wherein the direction perpendicular to the interface is the

direction of the crystallographically identical crystal axes generically described as the <111> axes.

49. An exchange coupling film according to Claim 47, wherein the antiferromagnetic layer and the ferromagnetic layer have the crystallographically identical planes generically described as the {111} planes, one of which is preferentially aligned parallel to the interface between the antiferromagnetic layer and the ferromagnetic layer.

50. An exchange coupling film according to Claim 47, wherein the antiferromagnetic layer and the ferromagnetic layer are deposited in that order from the bottom,

the exchange coupling film further comprising a seed layer provided below the antiferromagnetic layer, the seed layer mainly having a face-centered cubic structure and having crystallographically identical planes generically described as the {111} planes, one of which is preferentially aligned parallel to the interface.

51. An exchange coupling film according to Claim 50, the seed layer comprising one of a NiFe alloy and a Ni-Fe-Y alloy, wherein Y is at least one element selected from the group consisting of Cr, Rh, Ta, Hf, Nb, Zr, and Ti.

52. An exchange coupling film according to Claim 50, wherein the seed layer is nonmagnetic at room temperature.

53. An exchange coupling film according to Claim 50, further comprising an underlayer provided under the seed layer, the underlayer comprising at least one element selected from the group consisting of Ta, Hf, Nb, Zr, Ti, Mo, and W.

54. An exchange coupling film according to Claim 50, wherein at least part of the interface between the antiferromagnetic layer and the seed layer is in a lattice-mismatching state.

55. An exchange coupling film according to Claim 47, the antiferromagnetic material further comprising X', wherein X' is at least one element selected from the group consisting of Ne, Ar, Kr, Xe, Be, B, C, N, Mg, Al, Si, P, Ti, V, Cr, Fe, Co, Ni, Cu, Zn, Ga, Ge, Zr, Nb, Mo, Ag, Cd, Sn, Hf, Ta, W, Re, Au, Pb, and rare earth elements.

56. An exchange coupling film according to Claim 55, wherein the antiferromagnetic material is an interstitial solid solution in which X' is inserted to interstices in the lattice formed by X and Mn or a substitutional solid solution in which X' partly displaces lattice points in the crystal lattice formed by X and Mn.

57. An exchange coupling film according to Claim 56,

wherein the X or X + X' content in the antiferromagnetic material is in the range of 45 to 60 atomic percent.

58. An exchange coupling film according to Claim 47, wherein at least part of the interface between the antiferromagnetic layer and the ferromagnetic layer is in a lattice-mismatching state.

59. A magnetoresistive element comprising:

an antiferromagnetic layer;

a pinned magnetic layer in contact with the antiferromagnetic layer, the magnetization vector of the pinned magnetic layer being pinned by an exchanged anisotropic magnetic field generated in relation to the antiferromagnetic layer;

a free magnetic layer formed on the pinned magnetic layer separated by a nonmagnetic interlayer therebetween; and

bias layers for orienting the magnetization vector of the free magnetic layer in a direction substantially orthogonal to the magnetization vector of the pinned magnetic layer,

wherein the antiferromagnetic layer and the pinned magnetic layer comprises an exchange coupling film according to Claim 47, the pinned magnetic layer corresponding to the ferromagnetic layer.

60. A magnetoresistive element comprising:

an antiferromagnetic layer;

a pinned magnetic layer in contact with the antiferromagnetic layer, the magnetization vectors of the pinned magnetic layer being pinned by an exchange anisotropic magnetic field generated in relation with the antiferromagnetic layer;

a free magnetic layer formed on the pinned magnetic layer separated by a nonmagnetic interlayer; and

antiferromagnetic exchange bias layers formed above or below the free magnetic layer, the exchange bias layers being separated from one another in a track width direction by a gap therebetween,

wherein the exchange bias layers and the free magnetic layer comprise an exchange coupling film according to Claim 47, the exchange bias layers corresponding to the antiferromagnetic layer and the free magnetic layer corresponding to the ferromagnetic layer.

61. A magnetoresistive element comprising:

nonmagnetic interlayers provided below and above a free magnetic layer;

pinned magnetic layers, one thereof being provided on the pinned magnetic layer formed on the free magnetic layer and the other being provided under the pinned magnetic layer formed under the free magnetic layer;

antiferromagnetic layers for pinning the magnetization

vectors of the pinned magnetic layers, one of the antiferromagnetic layers being provided on one of the pinned magnetic layers and the other being provided under the other of the pinned magnetic layers; and

bias layers for orienting the magnetization vector of the free magnetic layer in a direction substantially orthogonal to the magnetization vector of the pinned magnetic layer,

wherein the antiferromagnetic layer and the pinned magnetic layer in contact with the antiferromagnetic layer comprise an exchange coupling film according to Claim 47, the pinned magnetic layer corresponding to the ferromagnetic layer.

62. A magnetoresistive element comprising:

a magnetoresistive layer;

a soft magnetic layer provided on the magnetoresistive layer separated by a nonmagnetic layer therebetween; and

antiferromagnetic layers provided above or below the magnetoresistive layer, the antiferromagnetic layers being separated from one another in a track width direction with a gap therebetween,

wherein the antiferromagnetic layer and the magnetoresistive layer comprise an exchange coupling film according to Claim 47, the magnetoresistive layer corresponding to the ferromagnetic layer.

63. An exchange coupling film comprising an antiferromagnetic film and a ferromagnetic film in contact with the antiferromagnetic layer, an exchange coupling magnetic field generated at the interface between the antiferromagnetic layer and the ferromagnetic layer magnetizing the ferromagnetic layer in a particular direction,

wherein diffraction spots corresponding to reciprocal lattice points indicative of crystal planes of the antiferromagnetic layer and the ferromagnetic layer appear in transmission electron beam diffraction diagrams of the antiferromagnetic layer and the ferromagnetic layer obtained using an electron beam in a direction perpendicular to the interface, and

wherein, among said diffraction spots, a diffraction spot given a particular label appears only in one of the diffraction diagrams of the antiferromagnetic layer and the ferromagnetic layer.

64. An exchange coupling film according to Claim 63, wherein the direction perpendicular to the interface is the direction of the crystallographically identical crystal axes generically described as the <111> axes.

65. An exchange coupling film according to Claim 63, wherein the antiferromagnetic layer and the ferromagnetic layer have the crystallographically identical planes

generically described as the {111} planes, one of which is preferentially aligned parallel to the interface between the antiferromagnetic layer and the ferromagnetic layer.

66. An exchange coupling film according to Claim 63, wherein the antiferromagnetic layer and the ferromagnetic layer are deposited in that order from the bottom,

the exchange coupling film further comprising a seed layer provided below the antiferromagnetic layer, the seed layer mainly having a face-centered cubic structure and having the crystallographically identical planes generically described as the {111} planes, one of which is preferentially aligned parallel to the interface.

67. An exchange coupling film according to Claim 66, the seed layer comprising one of a NiFe alloy and a Ni-Fe-Y alloy, wherein Y is at least one element selected from the group consisting of Cr, Rh, Ta, Hf, Nb, Zr, and Ti.

68. An exchange coupling film according to Claim 66, wherein the seed layer is nonmagnetic at room temperature.

69. An exchange coupling film according to Claim 66, further comprising an underlayer provided under the seed layer, the underlayer comprising at least one element selected from the group consisting of Ta, Hf, Nb, Zr, Ti, Mo, and W.

70. An exchange coupling film according to Claim 66, wherein at least part of the interface between the antiferromagnetic layer and the seed layer is in a lattice-mismatching state.

71. An exchange coupling film according to Claim 63, wherein the antiferromagnetic material further comprises X', wherein X' is at least one element selected from the group consisting of Ne, Ar, Kr, Xe, Be, B, C, N, Mg, Al, Si, P, Ti, V, Cr, Fe, Co, Ni, Cu, Zn, Ga, Ge, Zr, Nb, Mo, Ag, Cd, Sn, Hf, Ta, W, Re, Au, Pb, and rare earth elements.

72. An exchange coupling film according to Claim 71, wherein the antiferromagnetic material is an interstitial solid solution in which X' is inserted to interstices in the lattice formed by X and Mn or a substitutional solid solution in which X' displaces part of the lattice points in the crystal lattice formed by X and Mn.

73. An exchange coupling film according to Claim 72, wherein the X or X + X' content in the antiferromagnetic material is in the range of 45 to 60 atomic percent.

74. An exchange coupling film according to Claim 63, wherein at least part of the interface between the antiferromagnetic layer and the ferromagnetic layer is in a

lattice-mismatching state.

75. A magnetoresistive element comprising:

an antiferromagnetic layer;

a pinned magnetic layer in contact with the antiferromagnetic layer, the magnetization vector of the pinned magnetic layer being pinned by an exchanged anisotropic magnetic field generated in relation to the antiferromagnetic layer;

a free magnetic layer formed on the pinned magnetic layer separated by a nonmagnetic interlayer therebetween; and

bias layers for orienting the magnetization vector of the free magnetic layer in a direction substantially orthogonal to the magnetization vector of the pinned magnetic layer,

wherein the antiferromagnetic layer and the pinned magnetic layer comprises an exchange coupling film according to Claim 63, the pinned magnetic layer corresponding to the ferromagnetic layer.

76. A magnetoresistive element comprising:

an antiferromagnetic layer;

a pinned magnetic layer in contact with the antiferromagnetic layer, the magnetization vectors of the pinned magnetic layer being pinned by an exchange anisotropic magnetic field generated in relation to the

antiferromagnetic layer;

a free magnetic layer formed on the pinned magnetic layer separated by a nonmagnetic interlayer; and

antiferromagnetic exchange bias layers formed above or under the free magnetic layer, the exchange bias layers being separated from one another in a track width direction by a gap therebetween,

wherein the exchange bias layers and the free magnetic layer comprise an exchange coupling film according to Claim 63, the exchange bias layers corresponding to the antiferromagnetic layer and the free magnetic layer corresponding to the ferromagnetic layer.

77. A magnetoresistive element comprising:

nonmagnetic interlayers provided under and above a free magnetic layer;

pinned magnetic layers, one thereof being provided on the pinned magnetic layer formed on the free magnetic layer and the other being provided under the pinned magnetic layer formed under the free magnetic layer;

antiferromagnetic layers for pinning the magnetization vectors of the pinned magnetic layers, one of the antiferromagnetic layers being provided on one of the pinned magnetic layers and the other being provided under the other of the pinned magnetic layers; and

bias layers for orienting the magnetization vector of the free magnetic layer in a direction substantially

orthogonal to the magnetization vector of the pinned magnetic layer,

wherein the antiferromagnetic layer and the pinned magnetic layer in contact with the antiferromagnetic layer comprise an exchange coupling film according to Claim 63, the pinned magnetic layer corresponding to the ferromagnetic layer.

78. A magnetoresistive element comprising:

a magnetoresistive layer;

a soft magnetic layer provided on the magnetoresistive layer separated by a nonmagnetic layer therebetween; and

antiferromagnetic layers provided above or below the magnetoresistive layer, the antiferromagnetic layers being separated from one another in a track width direction with a gap therebetween,

wherein the antiferromagnetic layer and the magnetoresistive layer comprise an exchange coupling film according to Claim 63, the magnetoresistive layer corresponding to the ferromagnetic layer.